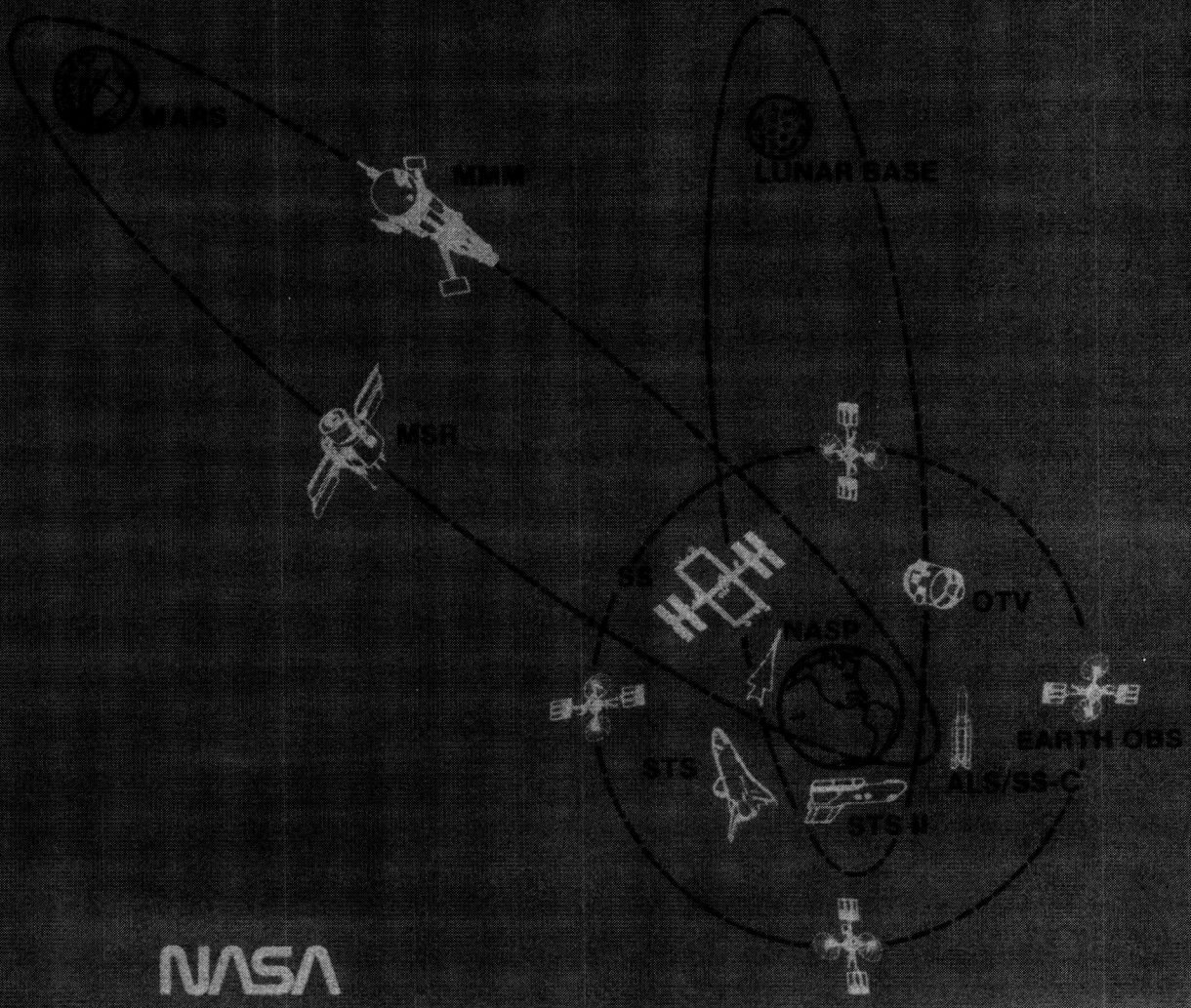
JOHNSON SPACE CENTER'S

STRATEGIC GAME PLAN

CHARTING A COURSE TO THE YEAR 2000 AND BEYOND



NASA

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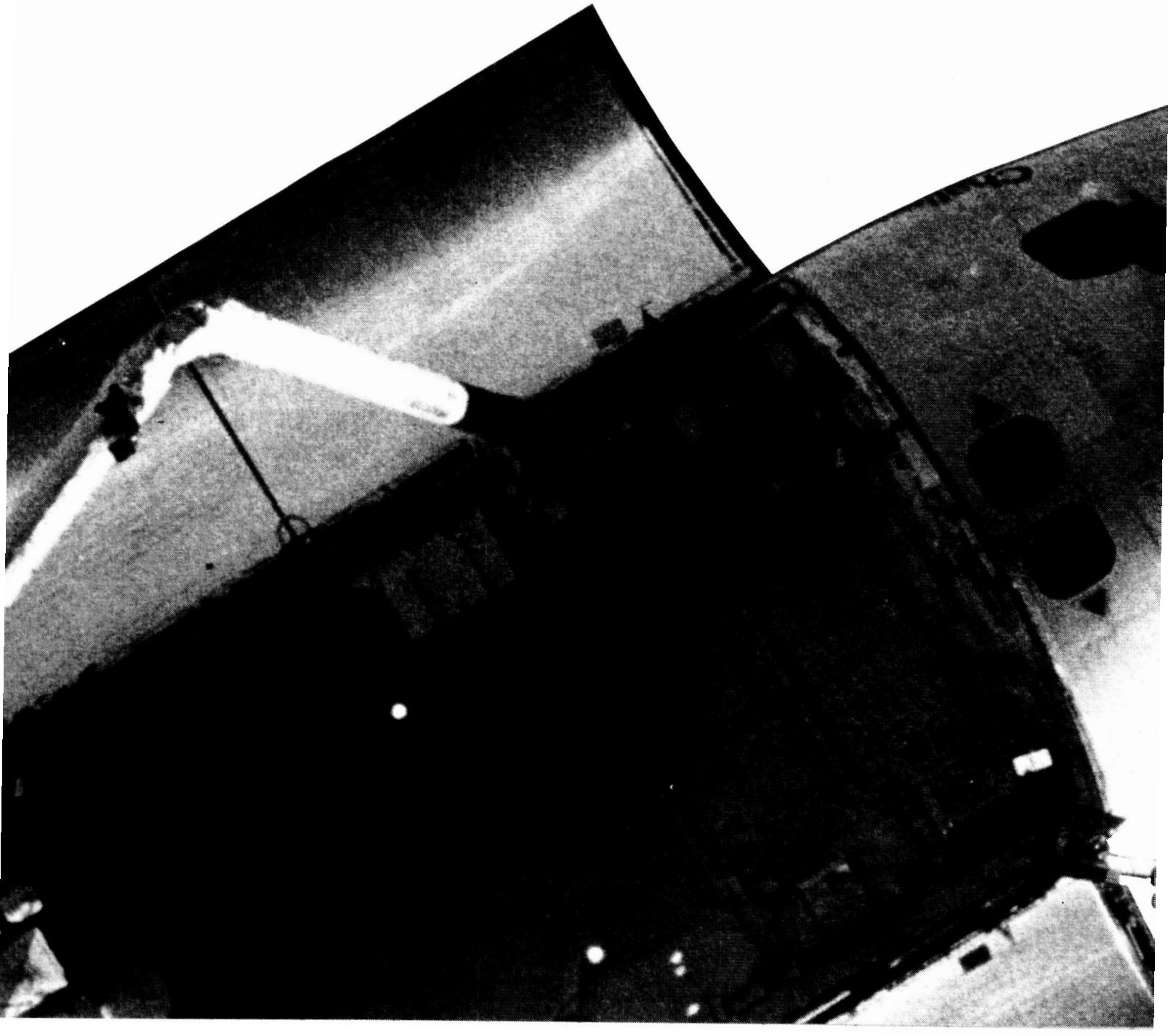
JOHNSON SPACE CENTER'S

STRATEGIC GAME PLAN

CHARTING A COURSE TO THE YEAR 2000 AND BEYOND

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas

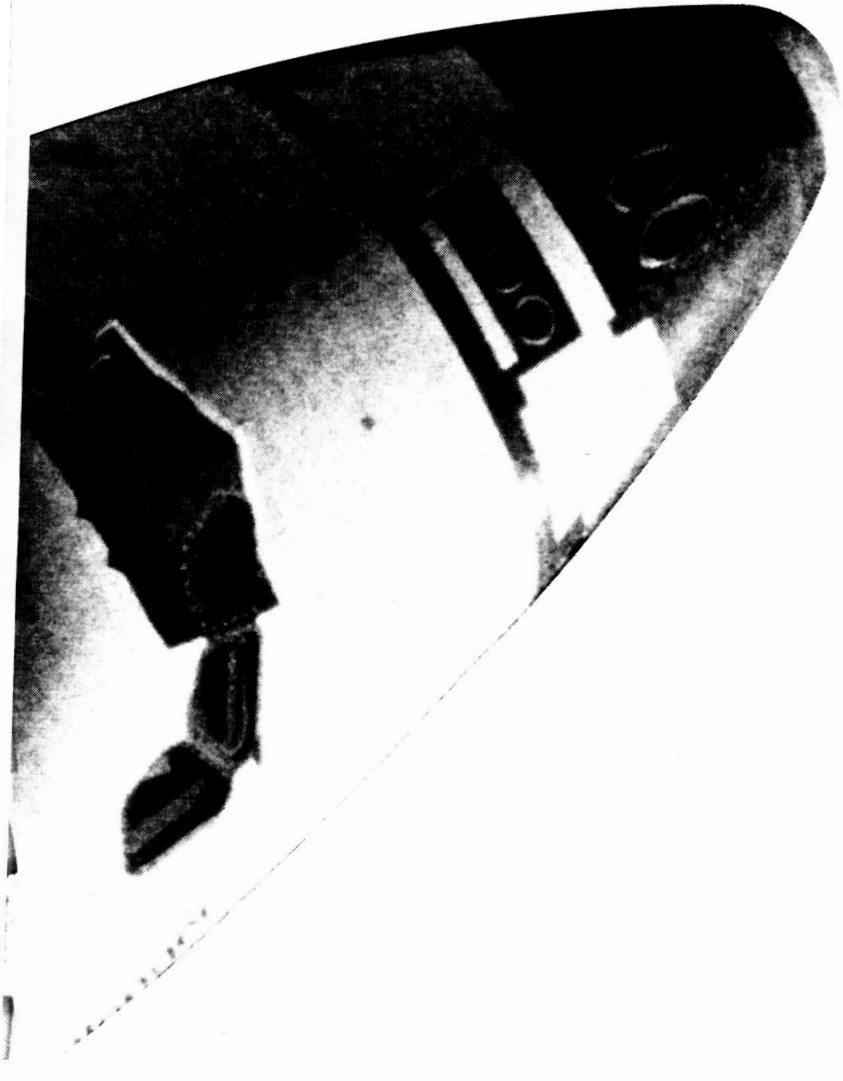
October 1987



"I would challenge you at NASA and the rest of America's space community: Let us aim for goals that will carry us well into the next century. . . . The goals that you set and your success in achieving them will have much to do with our children's prosperity and safety and will determine if America remains the great Nation it is intended to be. Don't be afraid to remind the rest of us of that once in a while."

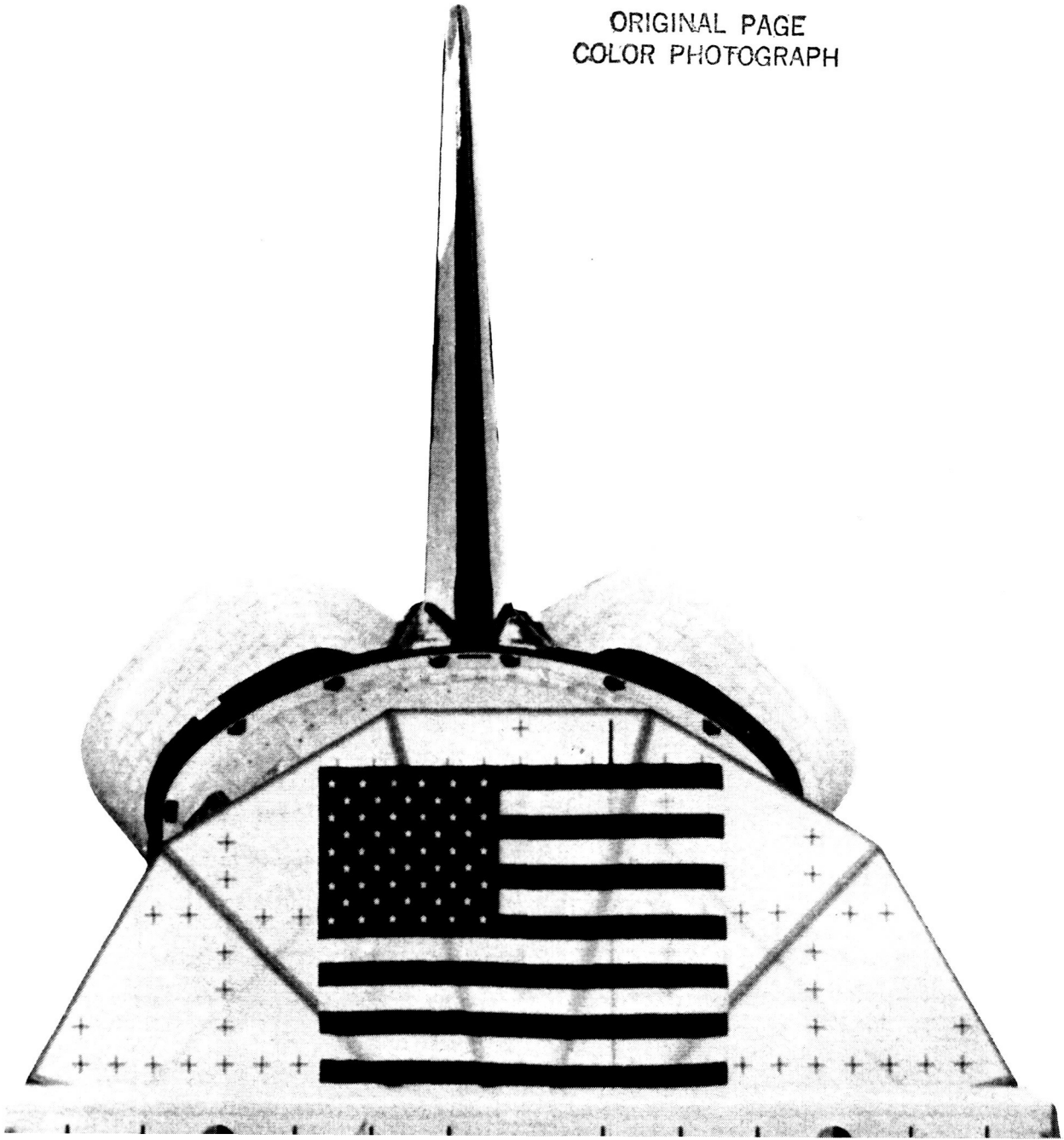
President Reagan

on the occasion of
NASA's 25th Anniversary
in October 1983



DIRECTOR'S MESSAGE

Last December when I first met with our Johnson Space Center (JSC) Strategic Planning Team members, I chartered them to recommend a bold plan for the Center to move forward to the year 2000. Specifically, I asked them to examine potential NASA initiatives and develop an approach which would best posture JSC, as part of the NASA team, to effectively sort out these initiatives while still meeting our Space Shuttle and Space Station commitments. Now, through their efforts and the guidance of the senior staff, I believe we have an excellent plan which will serve us well as we meet the challenges of the future.



DIRECTOR'S MESSAGE

As the planning process unfolded here at JSC, I became especially aware of several key messages:

1. ***We can influence our future in a complex, changing environment.*** While opportunities and uncertainties abound, and while future developments and timetables will not be totally under our control, I am convinced that we can influence the shape of our future. We can directly contribute to the shaping of alternative programs, and we can carefully choose to develop the technical capabilities that will be at the heart of NASA's manned space efforts.

2. ***Our Center's success requires us to pursue and achieve multiple goals at the same time.*** Not only must we perform extremely well on the two technical programs now before us, we must develop technical capabilities for the future, enhance our institutional base, and develop the relationships with our customers and other NASA centers necessary for success. We must carefully plan to reach each goal and allocate the necessary resources if we are to ensure JSC's future.

3. ***Our ways of working will need to change in order to be successful.*** Meeting multiple goals will not be easy. We must discover new ways to use our finite resources. We must develop more effective working partnerships with other NASA centers and other members of the U.S. space team in the development and enhancement of the basic technologies needed to accomplish new programs.

4. ***It is critically important to get started now.*** It will take time to sort through potential program initiatives, to shape alternatives, and to develop the base of technical capabilities that will enable us to make important program contributions in the future. We must start now to make decisions about today's programs in such a way that our future will remain vital.

5. ***We need the individual energy, commitment, and involvement of each JSC employee.*** The participation of over 200 JSC employees has made this planning document a reality. The participation of all JSC employees will be required to carry out our plan and enable us to remain a leading vital part of the overall NASA effort.

This plan is a living document that is designed to help us focus on the future as we see it today. Please read the plan carefully, consider its implications for you and your organization, and give us your energy as well as your feedback. As this plan evolves, we want it to be more valuable to the Center and more meaningful to you, the Center's greatest resource.

Aaron Cohen

Aaron Cohen
Director

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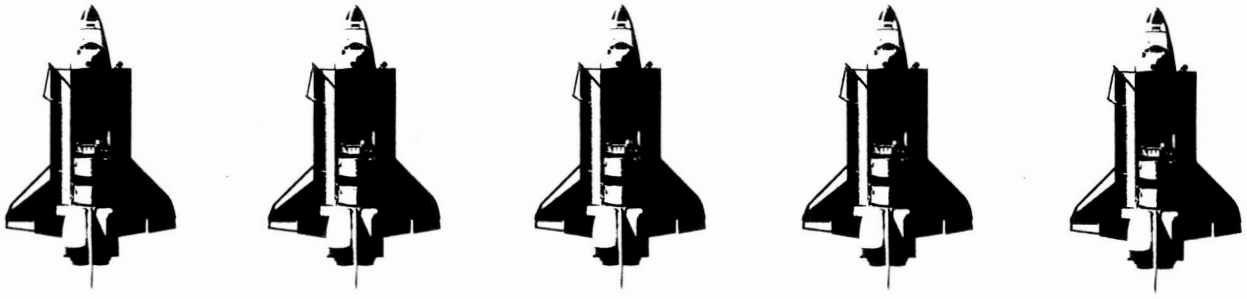
"The United States stands at still another turning point, one that is crucial for the future of our civil space program. It is clear that we must blaze new paths if we are to retain our leadership . . .

We recently began an effort to define the goals, objectives, and program thrusts to guide the future of the Nation's civil space program.

Our work will produce a vital and comprehensive blueprint to guide the United States to a position of long-term leadership among the spacefaring nations through the end of the century and beyond."

James C. Fletcher



THE JSC STRATEGIC PLANNING PROCESS

Strategy has been defined as a framework for guiding current choices which determine the nature and long-term direction of an organization. Strategic planning at the Johnson Space Center (JSC) is the process of developing a framework which will provide a basis for making more effective decisions—not at some time in the future, but now—for the achievement of our long-range goals.

One way to characterize the content of a JSC strategy framework is to list some of the questions which it attempts to answer. These questions include: What is the current state of JSC? Where will the space business be by the year 2000? What should JSC be doing in the year 2000? What critical factors must be considered so that our vision of the future can be realized?

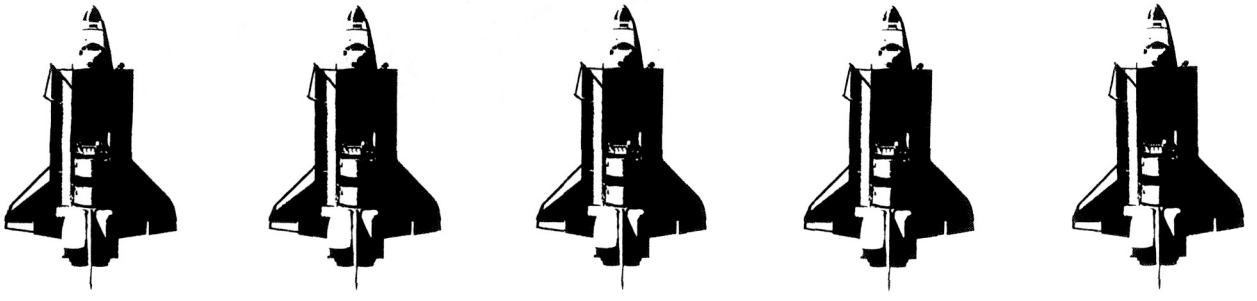
This document provides tentative, exploratory answers to these questions. The five basic goals which JSC will be striving to achieve are identified in Our Goals and Objectives. These goals include three technological goals as well as two other goals which are critical factors in our achieving the technical goals. Charting Our Future in Space examines a space scenario which suggests a world of space business significantly different from our present one. The sections entitled Enhancing Our Technologies and Capabilities and Your Use of This Document propose an approach which we at JSC can utilize now and in the immediate years ahead in preparing for our future role in space.

The JSC strategic planning process has been conducted within the guidelines and context of the NASA strategic planning process. In examining the year 2000 space scenario, several documents have been used. Two notable sources are *Pioneering the Space Frontier: The Report of the National Commission on Space* and, from the Office of Exploration, NASA Headquarters, *Leadership and America's Future in Space.*

It should be noted that this document is only one of the many byproducts of the JSC strategic planning process. As an example, working documents also have been developed which

- Summarize the technology/capability requirements for each of the candidate NASA initiatives listed on page 19
- Provide a current list and assessment of JSC's advanced technology/capability enhancement efforts

In summary, this document provides a working framework to guide current decisions necessary for achieving our long-range goals. It offers a look into the future to suggest a preliminary roadmap for determining how to proceed so that we are prepared for that future. It represents the thoughts and efforts of over 200 JSC employees who performed this task in addition to their ongoing responsibilities.



THE JSC MISSION STATEMENT

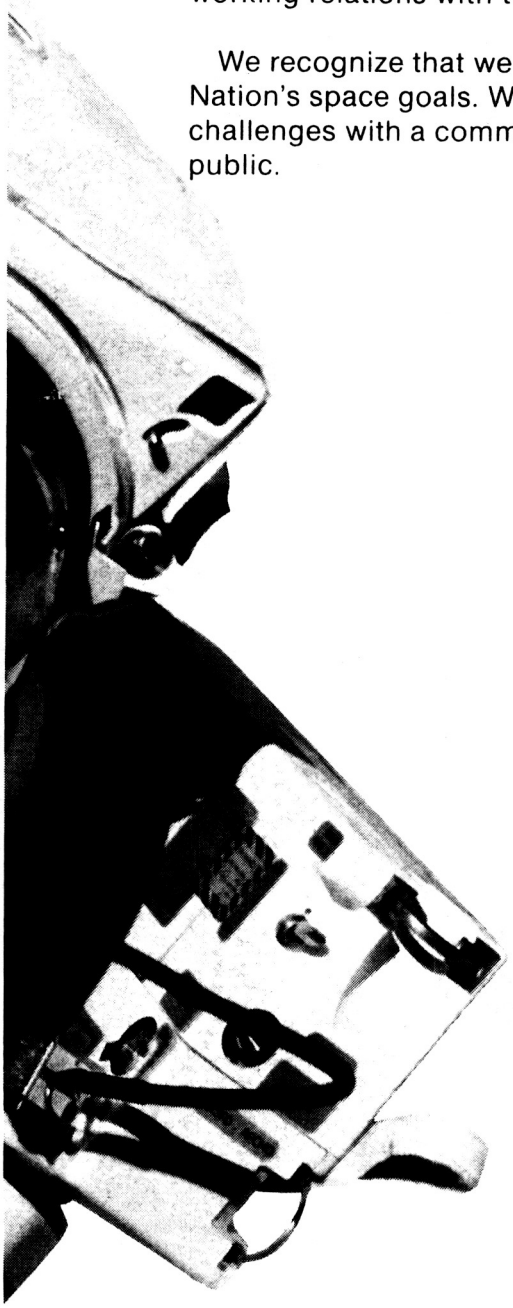
The Johnson Space Center has a major responsibility in ensuring the United States preeminence in manned space flight development and operations. Our primary mission is to develop and maintain those technologies and capabilities which are essential to building and operating manned space vehicles for exploration of the solar system. We also provide support to unmanned programs which require utilization of unique JSC facilities and expertise.

The safety of our flight crews is our first responsibility. To achieve that end, we must maintain the highest scientific, engineering, and operational standards.

Our success in accomplishing JSC's goals and objectives will be proportional to the technical excellence, initiative, and dedication of our employees. Therefore, we are determined to provide a working climate which will enhance their efforts.

Our Nation's achievements in space result from the combined efforts of government, industry, and universities. We are committed to promoting teamwork and effective working relations with these, our partners on the U.S. space team.

We recognize that we have been entrusted with major responsibilities in advancing the Nation's space goals. We accept these responsibilities and are dedicated to meeting these challenges with a commitment to excellence which exceeds the expectations of the U.S. public.



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The NASA Goals

The NASA's vision is to be at the forefront of advancements in aeronautics, space science, and exploration. To set its course into the 21st century and bring this vision to reality, NASA will pursue major goals which represent its aspirations in aviation and space.

- Advance scientific knowledge of the planet Earth, the solar system, and the universe beyond
- Expand human presence beyond the Earth into the solar system
- Strengthen aeronautics research and develop technology toward promoting U.S. leadership in civil and military aviation

Successful pursuit of these major goals requires commitment to the following supporting goals:

- Return the Space Shuttle to flight status and develop advanced space transportation capabilities
- Develop facilities and pursue science and technology needed for the Nation's space program

As NASA pursues these goals, we will:

- Promote domestic application of aerospace technologies to improve the quality of life on Earth and to extend human enterprise beyond Earth
- Conduct cooperative activities with other countries when such cooperation is consistent with our national space goals

The NASA goals have been developed as part of the NASA strategic planning process which is intended to guide the United States to a position of long-term world leadership in space exploration. As the next step in the process, specific objectives are being defined and program thrusts identified which are required to achieve these goals.

The JSC goals and objectives, highlighted in the pages which follow, have been developed as a part of the overall NASA strategic planning process.

The JSC Goals and Objectives

The Johnson Space Center has established five major goals toward which we must strive if we are to meet the Nation's expectation of maintaining U.S. preeminence in space.

The first three JSC goals are technical in nature. They define our basic mission—our reason for being. The immediate challenge is to effectively work these three goals in parallel. The two goals relating to Space Shuttle and Space Station are obviously the most demanding in their immediate claim for major resources. The third goal is equally important in that we must maintain and enhance our technical competence if JSC is to remain the vital organization it has been and is today. The resources required to achieve this goal are a fraction of the commitment for the first two goals, but these resources must be separately and carefully planned, justified, and allocated to ensure JSC's future.

The remaining two goals address the two critical success factors required for achieving the first three. One goal pertains to maintaining and enhancing our highly skilled work force. The other goal concerns our important relations with other key members of the U.S. space team.

The pages that follow list JSC's five goals along with a proposed strategy or approach for implementing each goal. Subsequently, each goal is accompanied by a brief explanation and a set of objectives. These objectives provide the specific targets of opportunity for focusing our immediate efforts.

The JSC Goals and Strategy Statements

Goal 1

Provide, maintain, and operate a safe, reliable, and effective National Space Transportation System (NSTS).

The NSTS is our number one priority. We will concentrate our efforts on the development and implementation of a disciplined approach leading to timely and clear recommendations, decisions, and technical implementation necessary to return Space Shuttle to flight status and toward improved flight performance.

Goal 2

Define, develop, and operate the Space Station system and capabilities necessary to achieve a permanent manned presence in space.

We will carry out our Space Station development and operational responsibilities while emphasizing the need to develop common support resources and integrated facilities for NSTS and Space Station. We will also, as appropriate, integrate the requirements for future uses of the enhanced Space Station as a transportation node, as a laboratory for low-g research, and as an exploration staging base.

Goal 3

Develop the critical technologies and capabilities necessary for the conception, design, development, and operation of systems for space transportation and exploration.

We will use the critical technologies and capabilities required for manned exploration of space rather than programs as the primary driver for shaping and participating in future programs. For each of the four major categories of technologies/capabilities—project management, space transportation development, manned space operations, and manned space exploration—we will identify the critical technologies for future programs, regularly assess our capabilities, and take action to maintain and enhance our posture within the limits of our resources.

Goal 4

Ensure the highest quality of personnel and support systems so that JSC can accomplish its responsibilities with excellence. Provide an environment that (1) promotes technical excellence, leadership, initiative, and creativity and (2) facilitates development and retention of a high-quality, conscientious, and dedicated work force.

We will regularly assess JSC's internal environment and take actions necessary to provide an environment which promotes leadership and excellence.

Goal 5

Enhance relationships with external constituents so that JSC can effectively carry out its mission responsibilities.

We will regularly identify our critical external interfaces, assess our roles and responsibilities, and develop effective and beneficial working relationships.

Goal 1: National Space Transportation System

Provide, maintain, and operate a safe, reliable, and effective National Space Transportation System.

Manned access to low Earth orbit is a prerequisite to man's permanent presence in space. Ensuring routine and reliable access to space must be an area of continuing emphasis in manned space flight.

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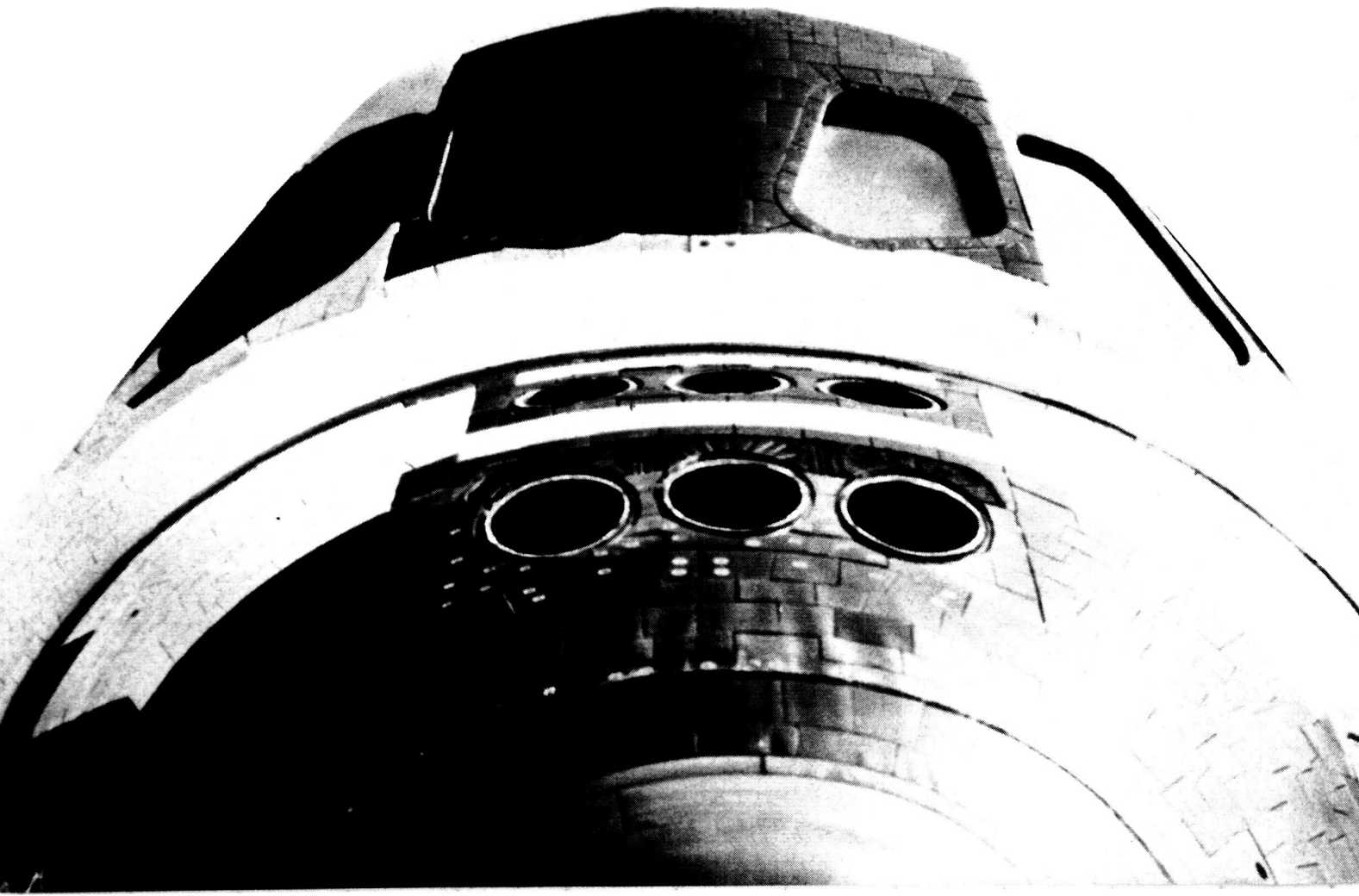


Goal 1 Objectives

A. Return the Space Shuttle system to safe flight status.

B. Reestablish the operations and performance boundaries that define the relationships among effective NSTS flight utilization, customer accommodations, and supporting resources while maintaining required margins for crew safety.

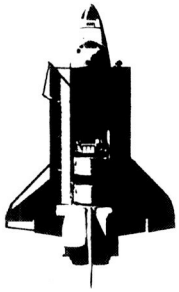
C. Build Orbiter(s) in support of the NSTS.

D. Aggressively initiate innovative performance improvements for NSTS.

E. Refurbish and upgrade support facilities as part of establishing an institutional and industrial base to sustain the program and make it more efficient.

F. Develop an effective, integrated on-orbit operations capability with Space Station, orbital maneuvering vehicle (OMV), and related support systems.

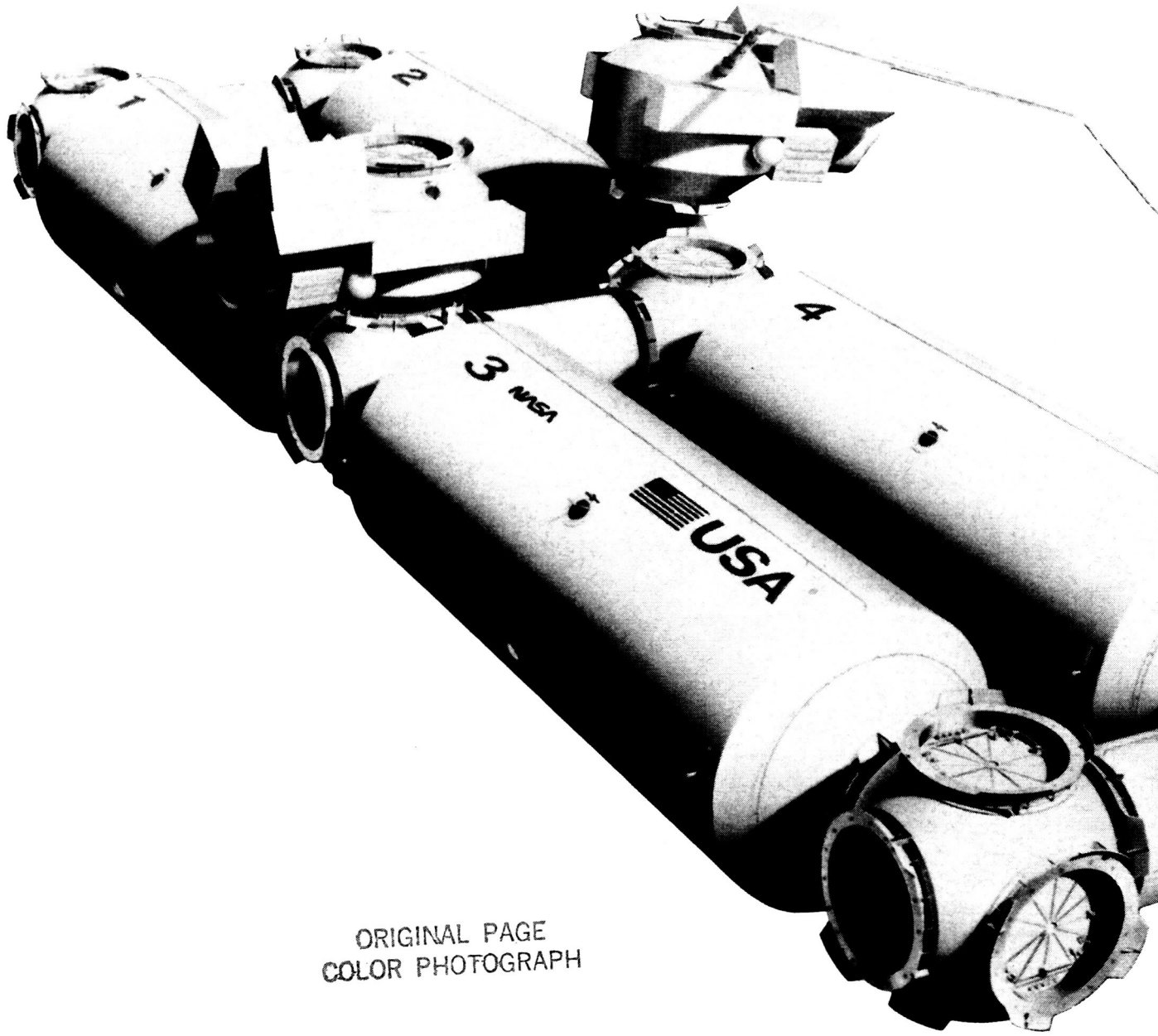
G. Lead in definition and development of a near-term, alternate manned access to space and future manned space transportation systems.



Goal 2: Space Station

Define, develop, and operate the Space Station system and capabilities necessary to achieve a permanent manned presence in space.

Space Station is the first major component of the infrastructure required to extend man's capability to live, work, and explore in space. It will serve in multiple capacities—as a laboratory facility, a transportation node, and a staging base for space exploration.



Goal 2 Objectives

A. Design, develop, integrate, and certify the assigned ground and flight systems necessary for assembly and operations.

B. Develop integration and operational capabilities required to accomplish on-orbit assembly, verification, and operations.

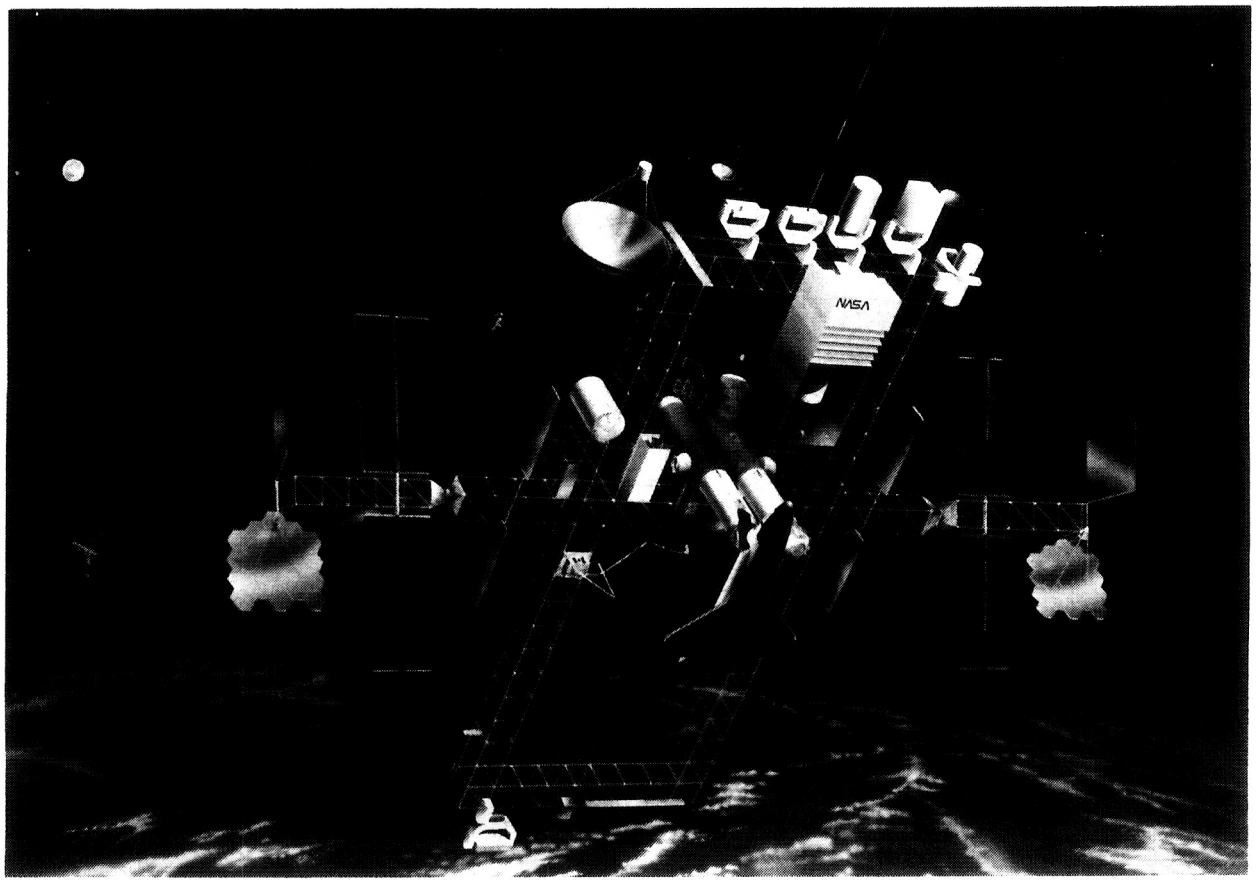
C. Accomplish assigned program integration tasks.

D. Design, develop, and operate the facilities and systems necessary for training and mission operations.

E. Design, develop, and operate a crew emergency return vehicle (CERV).

F. Continue the development of Space Station capabilities for use as an observatory, a laboratory facility for low-g research, a transportation node, and an exploration staging base.

G. Establish the institutional and industrial base to sustain the program.



Goal 3: Preparing Now for the Future

Develop the critical technologies and capabilities necessary for the conception, design, development, and operation of systems related to space transportation and exploration.

The nature of space business is changing. No longer do our programs have finite ends. More and more we will be required to conduct joint development and operations in a multiprogram environment. Space vehicles developed in one program will become part of the space infrastructure for the next program. Therefore, we must be more forward looking in understanding program interrelationships. To prepare ourselves for participation in these future programs, we must strengthen and increase our present core technologies and capabilities.

Goal 3 Objectives

A. Establish an integrated operations capability for the NSTS, Space Station, and associated manned and unmanned transportation system elements.

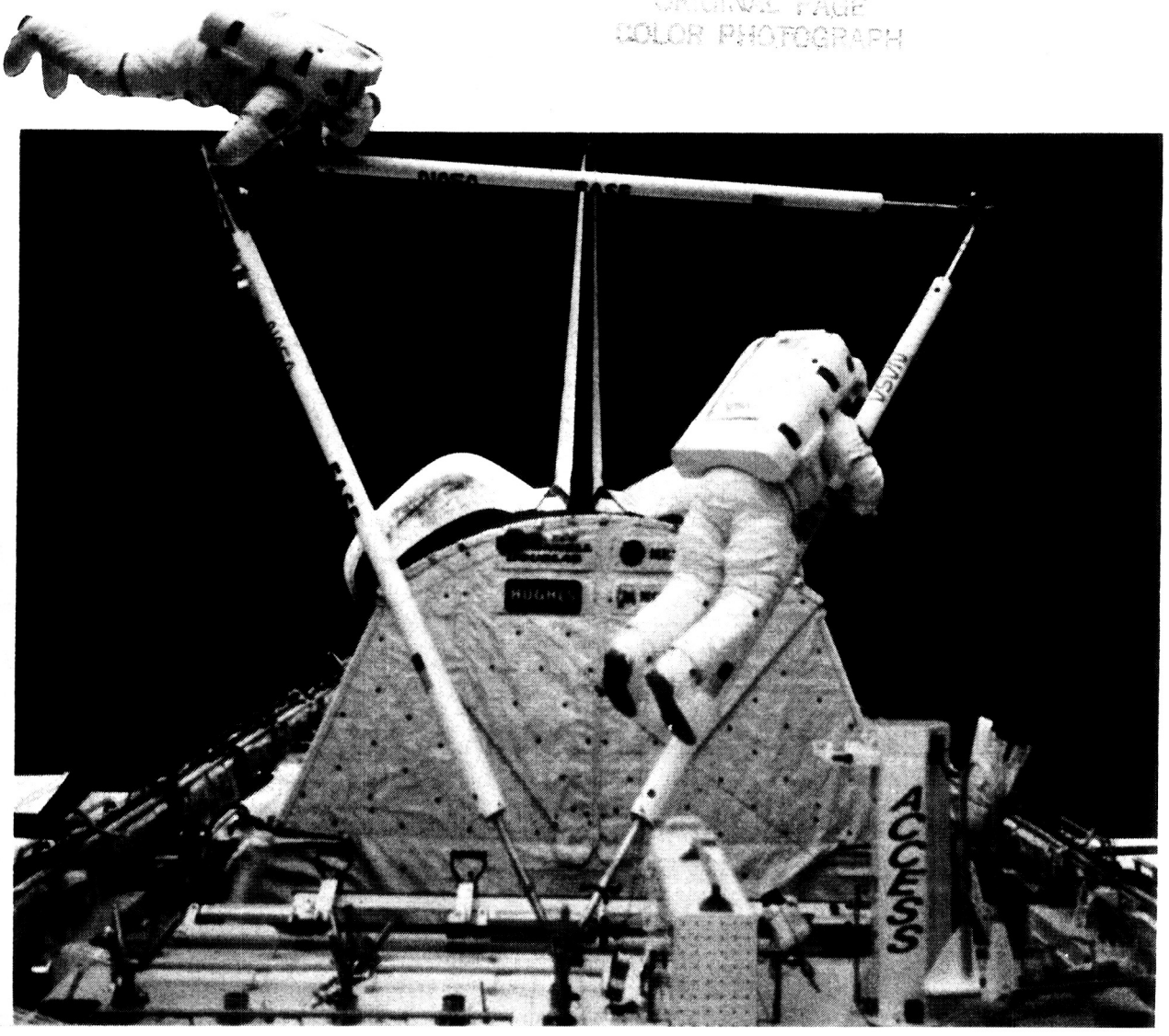
B. Strengthen advanced development programs, engineering, and operations disciplines for manned exploration of the Moon and Mars.

C. Pursue space and life sciences disciplines needed to make extended manned explorations achievable and productive.

D. Enhance the development and applications of data systems technology.

E. Accomplish flight experiments and demonstrations in science, engineering, and operations disciplines to assure technical excellence.

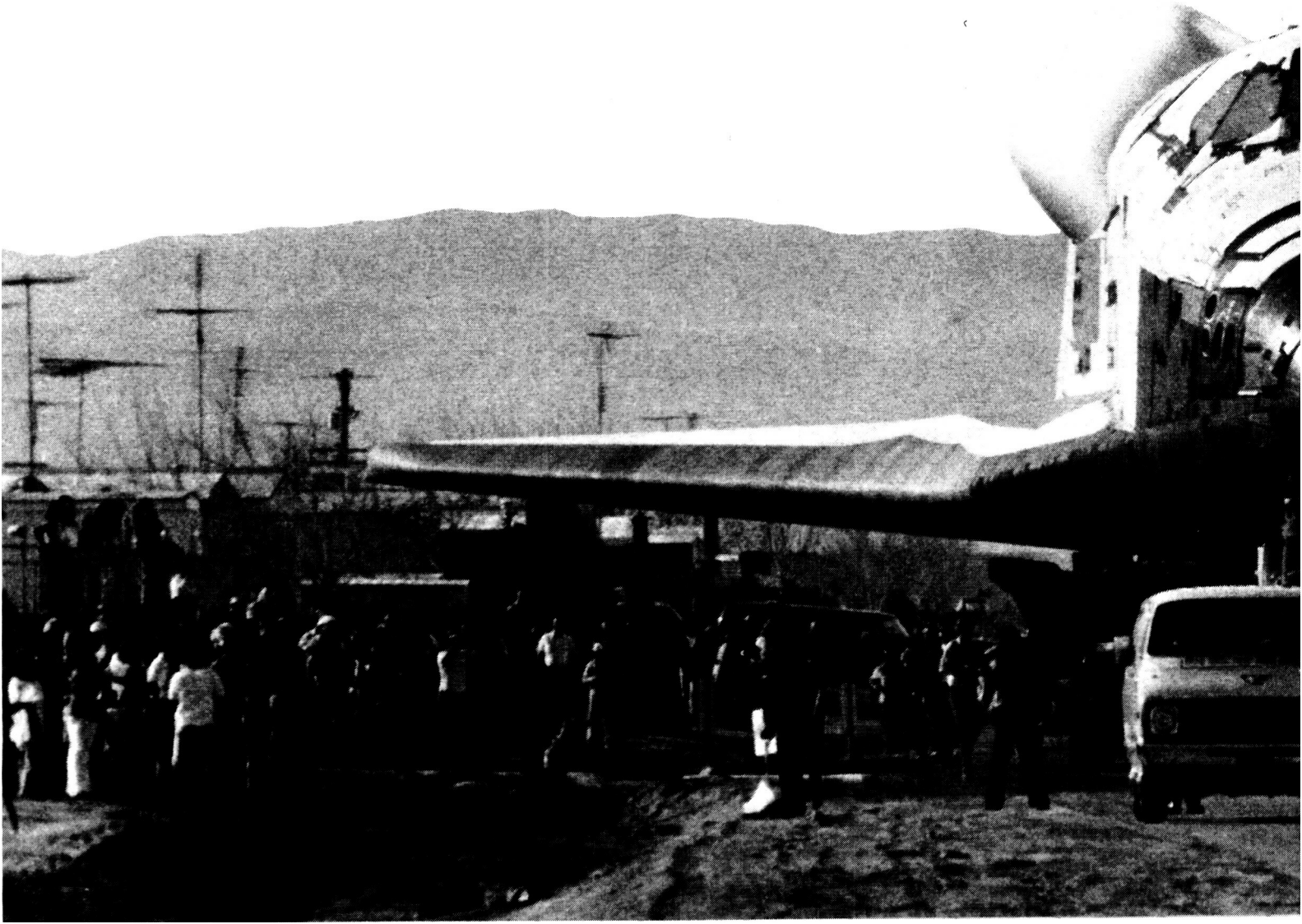
F. Develop project management systems and organizational relationships which will function effectively and efficiently in a multiprogram environment.



Goal 4: Institutional Excellence

Ensure the highest quality of personnel and support systems so that JSC can accomplish its responsibilities with excellence. Provide an environment that (1) promotes technical excellence, leadership, initiative, and creativity and (2) facilitates development and retention of a high-quality, dedicated work force.

The technical competence and dedication of JSC employees has been and will continue to be the principal driving force behind our program accomplishments. The future poses challenges which will stretch their capabilities. It will take a concerted effort at all organizational levels to ensure an optimal working environment.



Goal 4 Objectives

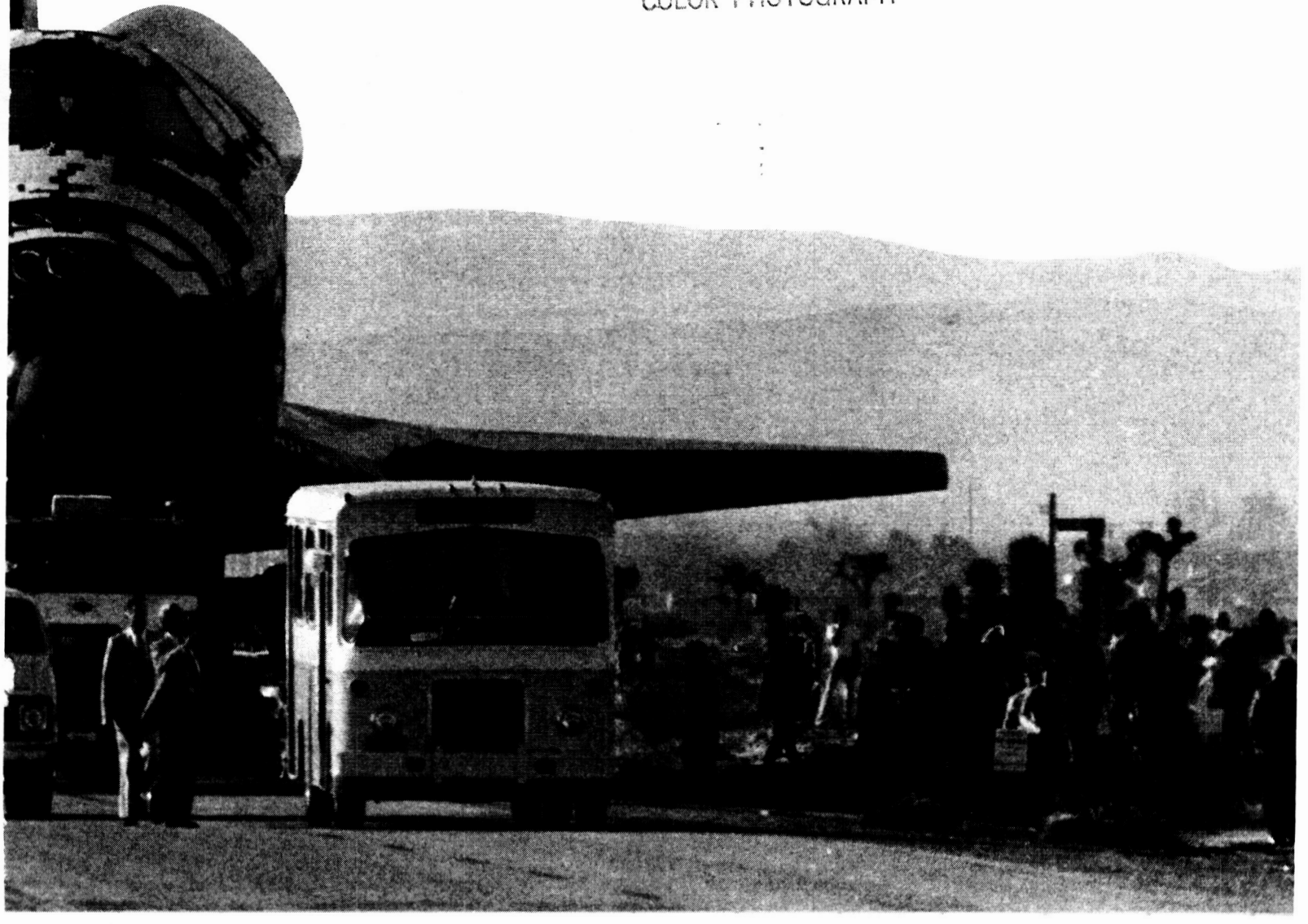
A. Develop and communicate clear goals and objectives.

B. Maintain well-defined organizational responsibilities and structure to facilitate effective decision making and resource utilization.

C. Ensure the development of technical and managerial expertise through job assignments, employee training, and career planning.

D. Encourage achievement through excellence, including openness in communications, pride in cooperation and teamwork, and recognition and reward for work well done.

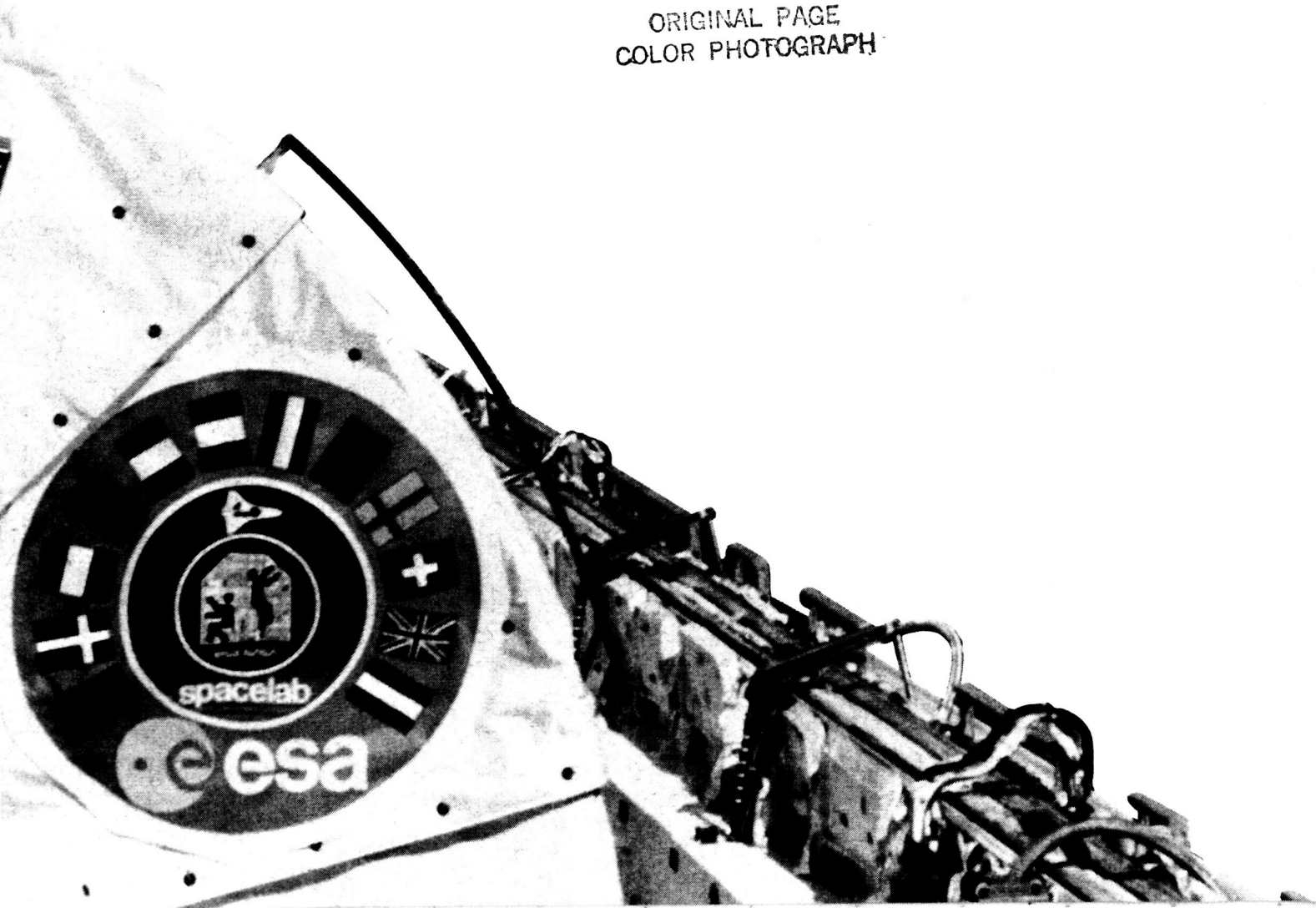
E. Support the continuing improvement of equipment, laboratories, and facilities necessary for performing high-quality work and enhancing skills.



Goal 5: Our Customers and Partners

Enhance relationships with external constituents so that JSC can effectively carry out its mission responsibilities.

Teamwork has been and will continue to be a fundamental tenet of the U.S. Space Program. As we move into an era of more complicated programs and space flight operations, special efforts will have to be made to build and manage effective interfaces among a complex array of our fellow space team members, our international partners, and our customers.



Goal 5 Objectives

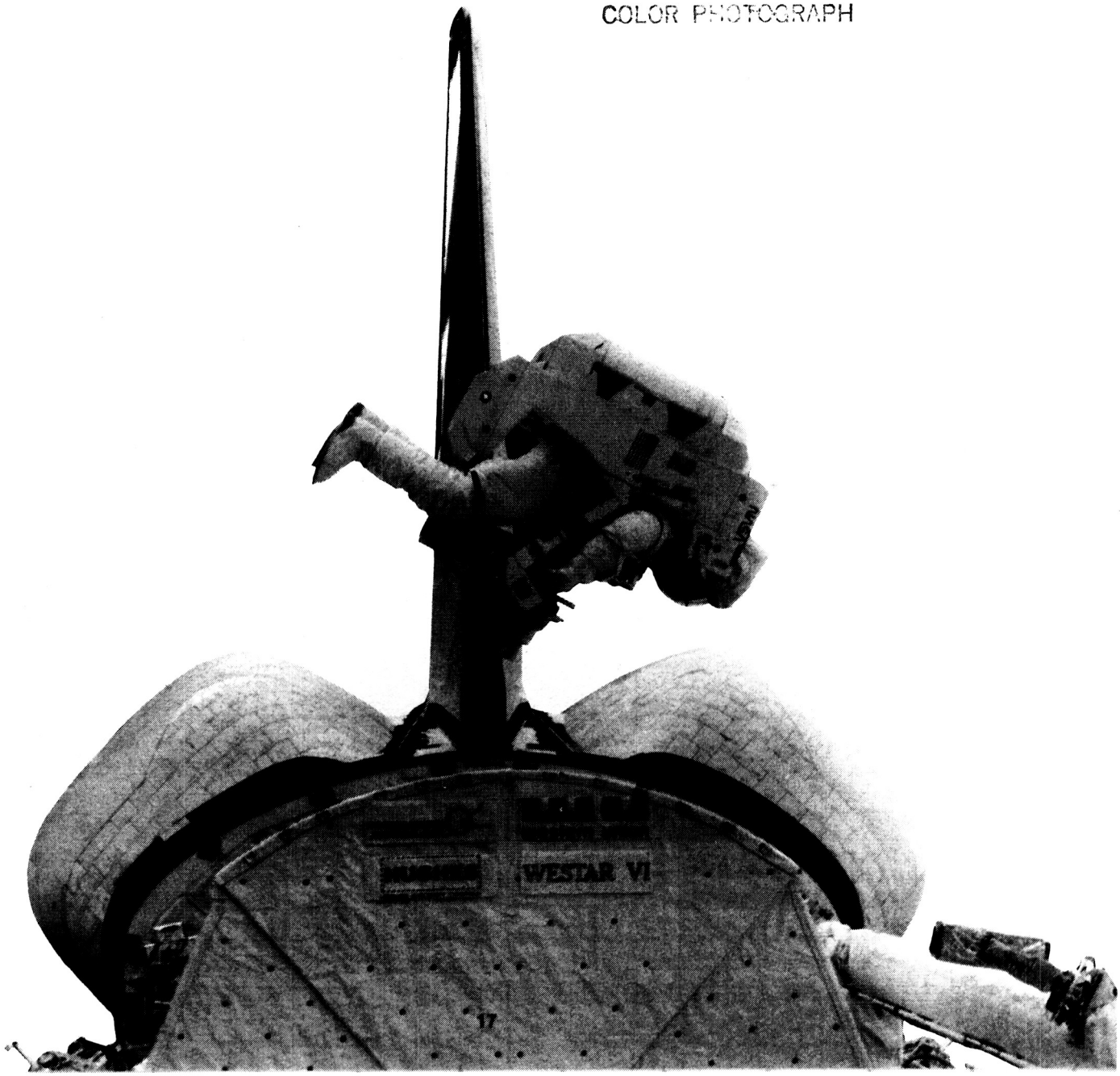
A. Provide responsive and responsible support to Agency initiatives and programs.

B. Ensure that program services/support provided to others is customer oriented.

C. Maintain well-defined relationships with and between contractors which encourage cooperation and teamwork and enhance the capability of the aerospace community.

D. Develop partnerships with NASA centers, universities, and other organizations to make most effective use of resources.

E. Promote cooperative working relationships with the Department of Defense in accomplishing joint initiatives and programs.



CHARTING OUR FUTURE IN SPACE

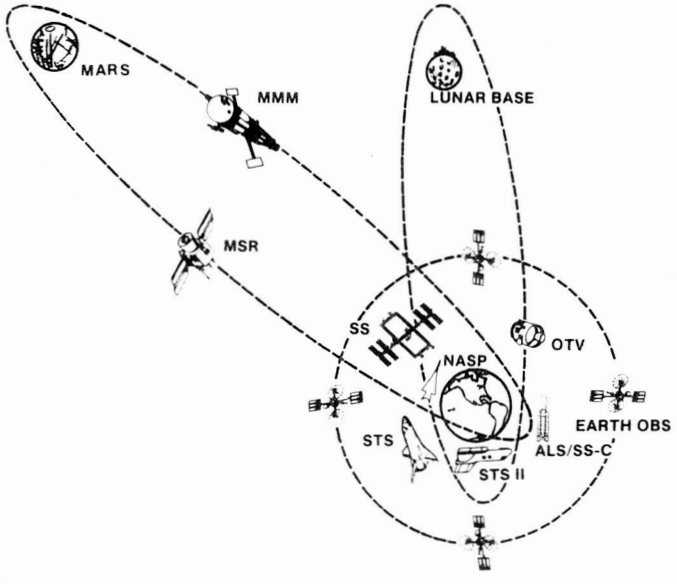
The NASA goal of establishing a permanent manned presence in space and exploring the solar system is a bold goal. However, it is no more of a challenge than was President Kennedy's goal in 1962 of landing a man on the Moon prior to 1970.

If we compare the program implemented to accomplish the 1962 goal with what is required by today's goals, we find a significant difference in the nature of the programs. In many respects, the Apollo Program was typical of past programs. It had a very specific objective, was essentially a stand-alone program, and was of relatively short duration. The era of manned space flight which we are now entering will be significantly different from that of the past 30 years. The new initiatives will have multiple uses, they will operate in conjunction with other program elements, and they will have substantially longer lifetimes, each leading deliberately into the next phase of the overall goals and objectives of the Agency.

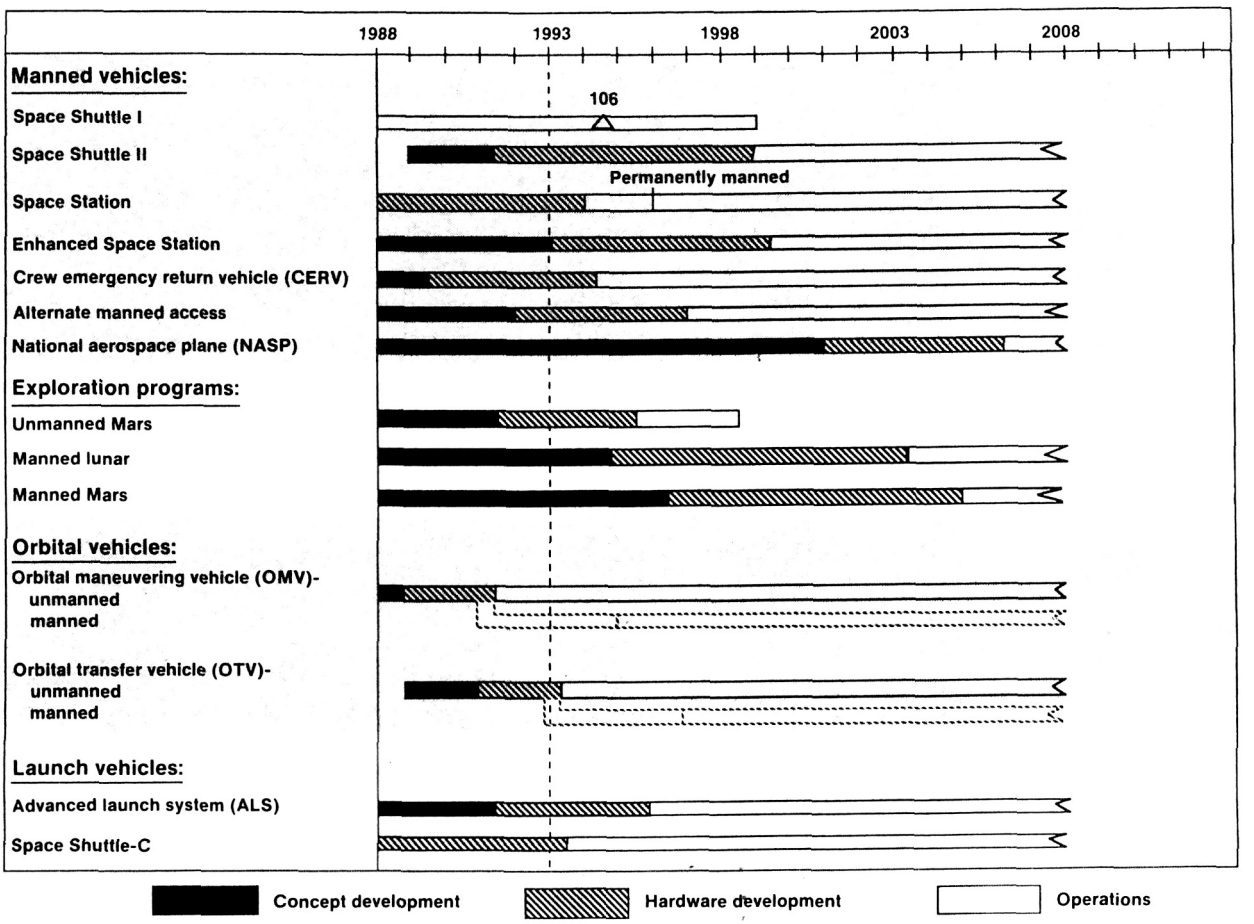
The chart on the facing page illustrates several facts which point to what the future will require of us as members of the U.S. space team. First, the number of potential initiatives involving manned space flight is significantly larger than in the past. Second, during the immediate years ahead, a significant number of these initiatives will be in their technical definition/concept development phases. Third, almost all of these initiatives, once approved, would involve a commitment of long-term support.

As each vehicle becomes operational, it represents an added work load of sustaining engineering and operations. Space hardware developed in one program will become part of the infrastructure for follow-on programs. As a result, there will be an increasing number of vehicles flying at the same time.

In current plans, the exploration and establishment of bases on the Moon and on Mars will evolve from an infrastructure of many vehicles and systems which already will have been operating in space. There will be many interdependencies among these programs. Therefore, potential initiatives cannot be properly evaluated in isolation. Each potential initiative must be examined in the context of a broader set of initiatives so that the interrelationships among them are understood and accounted for early in the planning and development phases.



Potential NASA Initiatives



The chart presents a broad array of potential initiatives. This list is not intended to be definitive; it is only a current checklist of constantly evolving initiatives. The status of these programs is varied; some are approved, funded programs, and some are planned programs. Some might best be described as candidate programs, while others are simply concepts to be explored.

During the immediate years ahead, these initiatives need to be examined, their interrelationships determined, and decisions made as to their role, if any, in a space infrastructure. Based on its extensive experience in manned space flight programs, the Johnson Space Center can perform a key role in supporting the Agency's efforts in defining requirements and in configuring an evolving space infrastructure.

The list of potential NASA initiatives has been categorized into four major groups. The paragraphs which follow briefly discuss these potential initiatives. The focus is on those initiatives which especially involve unique competencies which JSC has developed in previous manned programs. However, this focus clearly recognizes the necessary interdependencies between all NASA centers required to successfully achieve these initiatives. Because many of these initiatives have open-ended operations, early design decisions that affect the ease and efficiency of operations will have major impact on NASA and JSC in future years.

Manned Vehicles

These initiatives have been grouped together because of their interdependencies. Included in this category are two approved programs—the NSTS and the Space Station. These are existing commitments which will provide the foundation for future programs. A third vehicle in this category is the CERV, which will provide an emergency return-to-Earth capability for Space Station-based personnel. The other initiatives grouped in this category are (1) alternate manned access to space, (2) enhanced Space Station, (3) Orbiter 1 evolution, (4) second generation Space Shuttle, and (5) the National Aerospace Plane (NASP).

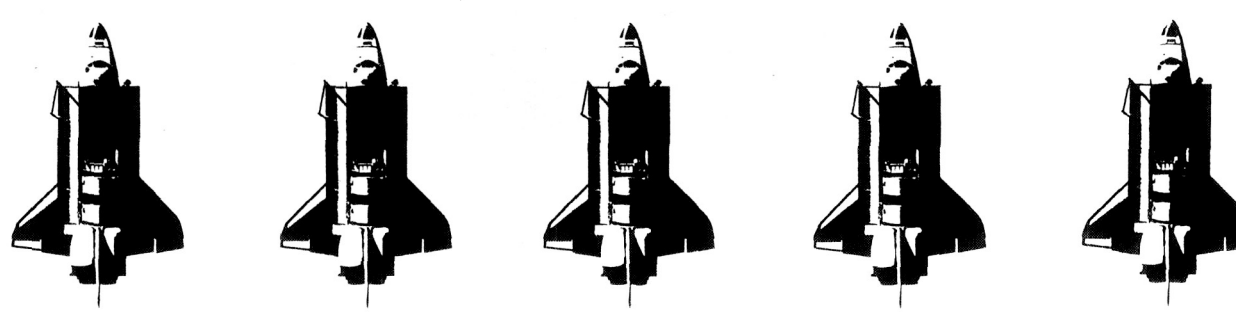
CHARTING OUR FUTURE IN SPACE

Returning Space Shuttle to reliable flight status and initiating the development of Space Station are our first two priorities. Concurrent with these two priority tasks we must also begin preliminary planning for (1) an integrated on-orbit operations capability for Space Shuttle, Space Station, orbital maneuvering vehicles, orbital transfer vehicles (OTV's), and related systems; (2) enhanced Space Station; and (3) improved manned access to space.

Because of Space Station's central position in future space missions, early consideration must be given to the development of an integrated operations capability with NSTS, unmanned cargo vehicles, manned and unmanned OTV's, and, later, vehicles developed for the exploration programs. At the same time, the requirements for the enhanced version of Space Station must be established, with special consideration of its role as a space-based research facility and staging base for exploration missions.

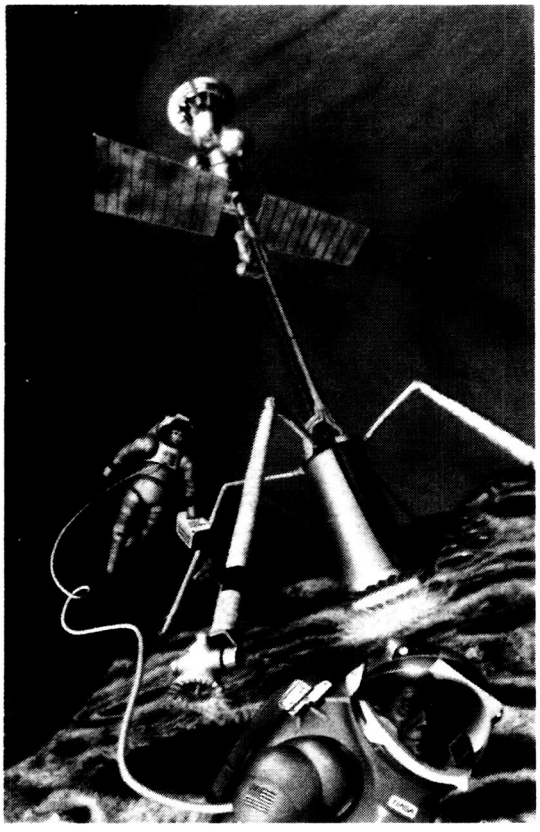
Improving man's access to space is of absolute necessity and involves exploring a number of different options including (1) the initiation of innovative performance improvements for the current NSTS evolving to an enhanced Space Shuttle, (2) the investigation of the feasibility of providing an alternate to the Space Shuttle as a manned access to space, and (3) the design and development of a second generation Space Shuttle to replace an obsolete first generation vehicle by the year 2000.

The effective development of these initiatives includes the necessity to maintain knowledge of the vehicle being developed by the U.S. Air Force (USAF) and Langley Research Center. This vehicle, the NASP, is also called the X-30 or, more colorfully, the "The Orient Express," and will function as a testbed for major technology breakthroughs in our efforts to improve man's access to space.



Exploration Programs

In May 1986, the National Commission on Space recommended a comprehensive U.S. space program leading to the manned exploration of the solar system. In December 1986, the Administrator issued revised goals which explicitly commit NASA to a major goal of expanding human presence beyond the Earth into the solar system. Since then, planning efforts have been underway to develop a set of specific objectives and program thrusts which will provide the focus for this goal.



A drilling platform for extracting water from either of the two moons of Mars.

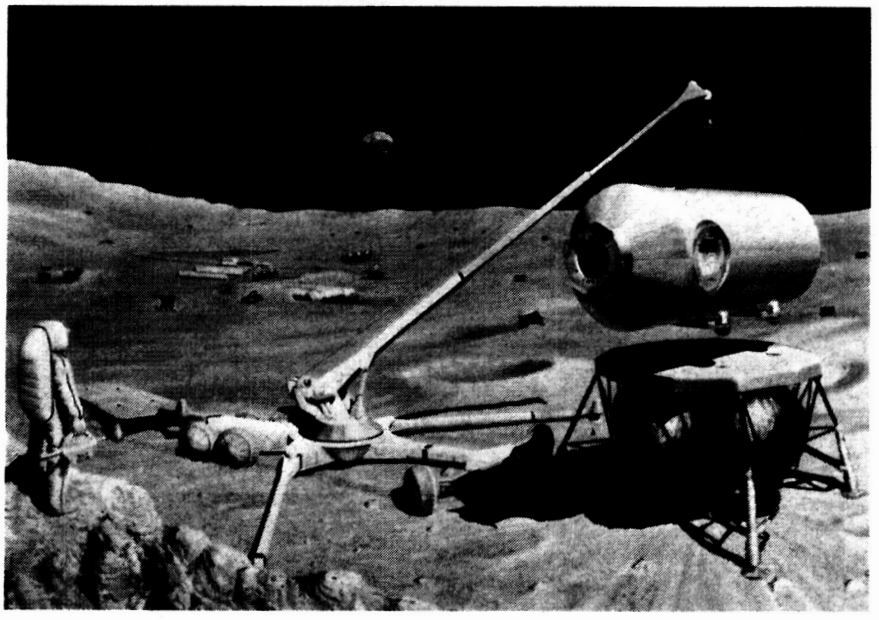
An unmanned nuclear-electric cargo ship for delivering large payloads to Mars orbit.

The three initiatives in this category are the unmanned Mars sample return mission, the manned lunar initiative, and the manned Mars initiative. These initiatives represent the most challenging and technically demanding set of missions ever proposed. They will require a commitment of resources by the Nation which is substantially above the current level. However, the National Commission on Space has concluded that by using a phased, economical approach, the required budget for any one year would represent a percentage of an expanding gross national product which would be less than one-half the percentage spent on space during the peak years of the Apollo Program.

Although the exact timing of the approval and full funding of these initiatives is problematical, that fact should not deter us from performing the necessary preliminary studies and building the technical base and space infrastructure needed for the ultimate development of lunar and Mars bases. There can be little doubt that our own commitment and our success in performing these preliminary tasks will affect the timing of the Nation's decision to renew an aggressive program of manned space exploration.

Unmanned Mars Sample Return Mission

The Johnson Space Center is currently participating with the Jet Propulsion Laboratory (JPL) in preliminary studies leading to a potential unmanned Mars sample return program. The JSC is focusing on those aspects of the mission associated with on-orbit assembly and servicing, mission operations, Mars/Earth sample handling interfaces, and selected vehicle design, development, test, and engineering together with the technology development for systems supporting these vehicles. Special consideration is being given to the use of the mission as a precursor to the design and development of the systems and vehicles for manned planetary missions.



A common module being removed from the descent stage in preparation for transport to a lunar base.

A highly self-sufficient Mars base.

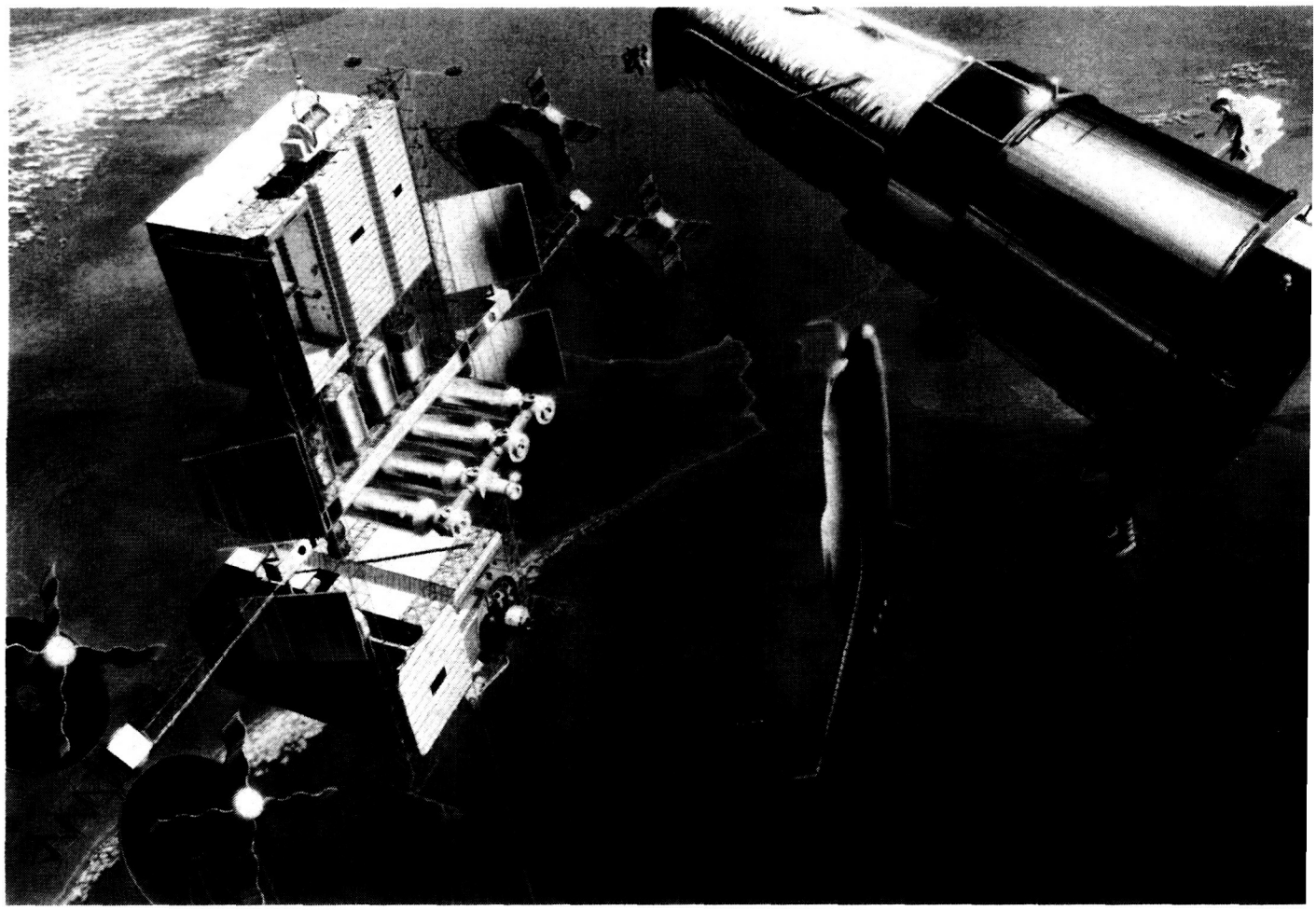
Manned Mars/Lunar Exploration Initiatives

These two major challenges—the establishment of a lunar base and the exploration of Mars—are considered together for a number of reasons. First, most of the space infrastructure required for these initiatives will be shared. For example, Space Station may be used as a staging, assembly, servicing, processing, and launch node for both a lunar base and a Mars mission. Second, one option under consideration is the use of the development process of a lunar base as a precursor to a Mars mission. This means that when the criteria are selected for the design, development, and certification of major mission elements such as spacecraft, descent/ascent vehicles, rover, habitat, and associated systems, the Mars requirements as well as the lunar requirements would be considered.

The Johnson Space Center, as part of the broader NASA effort, will develop concepts and associated cost and schedule data for elements in the manned Mars/lunar exploration initiative. Early project planning will have as a primary objective the identification of the technology and science requirements (e.g., variable-g facility, controlled environment life support system, orbital testbeds, etc.) necessary to accomplish the mission objectives for the manned Mars/lunar exploration.

Orbital Vehicles

Among the multifaceted roles which the Space Station will perform is that of an operational center for satellite servicing. There are two classes of evolutionary orbital vehicles currently planned which will have the capability to transfer a variety of payloads and satellites into different orbits and thereby greatly extend the flexibility and capabilities of Space Shuttle and Space Station.



An orbiting "service station" in low Earth orbit providing a vital link to the space infrastructure.

Marshall Space Flight Center (MSFC) is managing the development of a free flying mini-tug, the unmanned OMV; JSC will be responsible for the flight operations for the OMV and will support the MSFC development activities by providing space operations requirements and insights into the development process. In addition, plans include a reusable, high-performance upper stage OTV, based on and launched from Space Station, which will transport vehicles to geosynchronous orbit and possibly provide interplanetary transportation.

Although these vehicles are presently designed as unmanned, it may prove feasible and practical to substantially extend their capabilities by man rating them and developing requirements for piloted versions of these transfer vehicles. In addition, early design considerations may establish the OTV as a manned transfer stage to the Moon.

Launch Vehicles

There are currently two new launch vehicle systems being planned–the Space Shuttle-C (cargo), a Space Shuttle-derived cargo vehicle, and the advanced launch system, a USAF launch vehicle. The JSC will support the development of these vehicles by providing engineering and operations specialists to serve on control boards and review teams and as consultants for the MSFC and the USAF. The JSC will perform flight operations planning for interfaces with the Space Station as well as other associated in-flight operations.

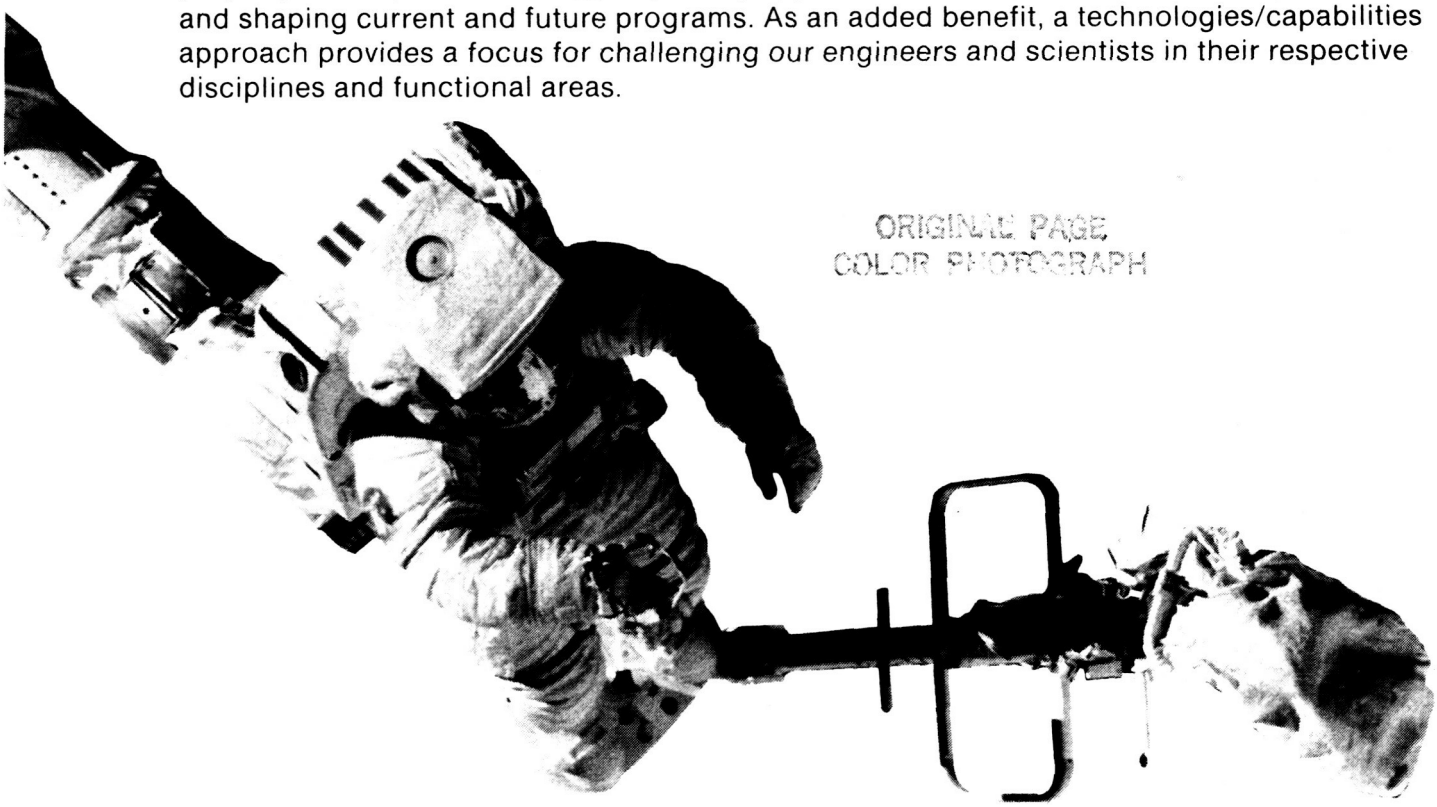
ENHANCING OUR TECHNOLOGIES AND CAPABILITIES

If the potential NASA initiatives were all approved for immediate implementation, they would present an insurmountable challenge to NASA. The task facing NASA, however, is not one of immediately implementing this array of potential initiatives. Instead, the task at hand is to develop a better understanding of these initiatives—their requirements and their interrelationships—and from this understanding to develop a systematic program of staged implementation.

Based on its review of the potential NASA initiatives over the past months, the JSC Strategic Planning Team has determined that an effort must be initiated at once to strengthen and enhance our technologies and capabilities. It is essential that we continue that which was begun in the strategic planning process: to assess thoroughly the core requirements which would be imposed by future programs, to evaluate our current technologies and capabilities in these areas, and to take actions now which will enable us to satisfy these requirements.

In the past, individual programs have driven technology. However, in the future, with more program elements operating in space concurrently, there will be an increasing need for technology requirements to be balanced across an array of programs, both currently operating programs as well as those on the drawing boards. As a result, technology will perform an increasingly significant role in shaping programs. To understand and accommodate the interrelationships among technologies and programs, we must be more forward looking in understanding our technology needs and developing our capabilities.

Although we do not know which initiatives will ultimately be approved or the timing of that approval, we do have sufficient information to identify the critical technologies and capabilities required for the most demanding of these initiatives—the exploration missions. By using the earlier programs to gain knowledge for these critical technologies, we can immediately begin a technology/capability development program. A balanced, properly developed technology/capability approach can provide a basis for integrating and shaping current and future programs. As an added benefit, a technologies/capabilities approach provides a focus for challenging our engineers and scientists in their respective disciplines and functional areas.



ENHANCING OUR TECHNOLOGIES AND CAPABILITIES

The anticipated direction of our Nation's space program necessitates our appraisal of almost all of our traditional functional areas and disciplines in light of the requirements of future programs. These requirements will demand a significant performance increase in most disciplines. This fact coupled with the evolutionary, if not revolutionary, developments anticipated in most technological areas necessitates an immediate special effort to understand the potential impact within each discipline in the next 10 years. Rapid advances can be expected to revolutionize aerospace capabilities in such areas as aerosciences, structures, and materials; electronics and optics; information, computation, and displays; propulsion and power; and many other disciplines.

Our role in regard to these disciplines is not ordinarily one of research; our role is to utilize the technologies which satisfy our requirements that have been developed by NASA research centers, other government agencies, or industry. We must ensure that JSC participates in the definition and establishment of research requirements to be addressed by these centers of research. We also must understand the new technologies from a development and/or an applications standpoint in order to have the technical capability to effectively utilize them in manned space flight.

The technologies and capabilities shown below are those which JSC utilizes in accomplishing its basic mission. These are the areas of our technical competence developed in carrying out previous programs from Apollo to Space Shuttle. The 37 technologies and capabilities have been grouped into four major categories—project management, space vehicle development, manned space exploration, and manned space operations. It is their synergistic co-location that affords JSC its unique strengths and capabilities. In order to ensure that these technologies and capabilities are properly focused and emphasized, we will periodically review potential initiatives to identify critical technologies and regularly assess our capabilities against these further requirements.

JSC Technologies and Capabilities

Project management		
• Systems engineering and testing • Safety, reliability, and quality assurance	• Systems integration • Configuration control • Cost/schedule control • Procurement	• Risk management/control • Manufacturing • Logistics
Space vehicle development	**Manned space exploration**	**Manned space operations**
• Environmental definition • Concept and systems design • Structures/materials mechanisms • Propulsion • Power • Thermal control • Guidance, navigation and control • Avionics • Recovery (if necessary) • Automation/robotics/artificial intelligence • Aerothermodynamics	• Environmental control life support • Environmental definition and protection • Extravehicular activity • Communications • Man/machine interface (human factors) • Biomedical • Information systems/data management • Crew recovery/escape	• Mission planning (including contingency) • Flight design • Training • Ground and flight control • Information system data management • Tracking/ranging/docking/recovery • Automation/artificial intelligence • Science/technology • Servicing/maintenance

Technologies and Capabilities Requiring Special Emphasis

There are a number of JSC disciplines and functional areas in which the new initiatives require a special effort to advance the state of the art. These areas are ones in which JSC has demonstrated unique expertise and participates in research and development activities as they relate to manned space flight. The areas which will require special emphasis include life sciences and biomedical research, environmental control and life support systems, human factor design and accommodations, extravehicular systems developments and productivity enhancements, aerodynamics, rendezvous and docking, environmental analysis and protection, and planetary sciences.

There are also a number of other broad, multidisciplinary areas of critical importance where increased emphasis must be placed. These areas include information management systems, sustaining engineering and operations, and in-flight space servicing. For example, the challenge of successful incorporation of data systems technology crosses a wide variety of functional areas including project engineering and management, engineering, operations, and science data bases, system/subsystem automation, training and simulations, flight control, and safety, reliability, and quality control.

Another major area where special emphasis must be placed involves the development of innovative strategies for handling the increased number of space vehicles which will require sustaining engineering and operations support.

A third area of growing importance is in-space construction, servicing, repair, refurbishment, and retrieval. These activities involve the integrated development of JSC technologies and capabilities in such areas as extravehicular activity systems, telerobotics, space mechanisms, fluid systems design, mission planning, flight design, simulation, and operations.

Technologies and Capabilities Requiring Special Emphasis

Human Life Support

- ECLSS and CELSS (particularly regenerative)
- Physiology/psychology of long-duration space flight
- EVA
- Habitat/crew accommodations/health maintenance
- *Radiation management*
- "Artificial g" capability

Man/machine systems

- Automation and robotics
- Systems autonomy/expert systems/AI
- Systems maintainability by crew

Space transportation

- Materials
- Propulsion
- Aerobraking
- Debris management
- Human-tended transportation nodes

Information systems

- Hardware
- Software
- Information management

In situ resources utilization

- Mining/bulk materials handling
- Materials processing

Space servicing (e.g., fluids transfer, vehicle assembly)

Construction (space and planetary)

Power

Multiprogram management

Operations and analysis (mission planning, technology evolution)

Systems engineering and integration

Improvements Required in Institutional Capabilities

An integral part of improving JSC's capabilities to support the potential new initiatives is enhancing JSC's institutional flexibility and capabilities. Major enhancements will be required in the way we carry out our activities in the areas of human resources development, business management, and Center operations. Each of these areas will be required to increase its level of performance to meet the institutional requirements associated with these new initiatives.

Institutional Capabilities

Human resources management and development

Business management

- Financial management
- Procurement
- Legal
- Public affairs

Center operations

- Management services
- Technical services
- Plant and facilities
- Photography/television
- Logistics

Basic Guidelines and Strategy

The conceptualization, development, and operation of manned spacecraft and space exploration programs has always been an extremely complex technological undertaking. The growing interdependency of missions and programs as well as the technological revolutionary advances in many fields indicate that the complexity of space flight will continue to increase. As in the past, the only way we will be able to succeed in carrying out these challenging missions is through the individual effort, skill, and commitment of not a few, but of all of us working together as a team in a wide array of disciplines and functional groups. The development of this document can be credited to the process of broad involvement and teamwork; indeed, our future success in achieving our goals and objectives depends upon the effectiveness of our teamwork.

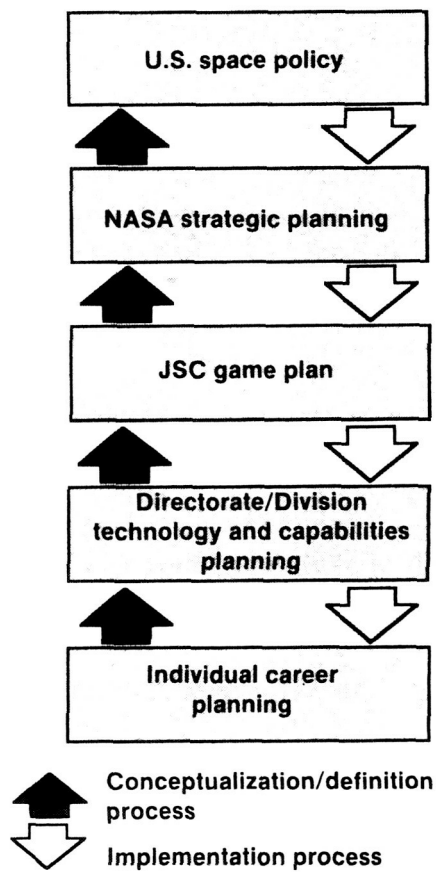
The next step in shaping our future requires that we broaden the process of involvement and teamwork. Organizations and individuals, utilizing the information and guidelines provided, must develop their own implementation plans. The JSC goals, objectives, and strategy statements provide the basic guidelines for the direction of these future efforts.

The scenario of potential missions and programs provides a context for analyzing and developing a preliminary understanding of future technological requirements in each of the respective disciplines and multifunctional areas.

The strategy of beginning immediately to strengthen and enhance these disciplines and capabilities provides a logical and systematic approach for building the technological base necessary to effectively carry out these missions.

To be most effective in the long run, this planning process requires that individuals as well as organizations at all levels analyze their own roles, responsibilities, and opportunities as they relate to the JSC goals and objectives, the program scenario, and the requirement to build a strong core technology base.

In a technology-based organization such as JSC, the development and implementation of a long-range plan requires input from all organizational levels. This multilevel involvement is critical because the strength of JSC is based on the wide diversity of technical expertise and competence within our first-line organizations. The planning process must be an iterative one, allowing for ideas and information generated at various levels to be disseminated and considered throughout the organization. The complex nature of our work requires full participation at all levels in the conceptualization, definition, and implementation process.



YOUR USE OF THIS DOCUMENT

Center-Level Plans and Actions

During the coming months, JSC management will take action to implement the goals and objectives detailed in this document in a manner that is consistent with the strategic planning approach. These actions will include organizational realignments as necessary to better focus our efforts to meet changing program requirements and to provide increased visibility and emphasis for technology and capability. Responsibilities for implementation of JSC goals and objectives will be assigned. In addition, actions are being initiated to coordinate Center efforts with Headquarters, other NASA centers, and contractors.

Responsibilities of Project Offices, Directorates, Center Staff Offices, and Divisions

Each program office, directorate, Center staff office, and division will participate in the planning process represented by this document and begin establishing specific implementation strategies to achieve our goals and objectives. Although coordination and participation will be required at all working levels, each organization can begin its own plans for implementation. Each organization can

1. Review the JSC goals and objectives and related strategy statements and develop action plans for those relating to your organization

2. Review the potential NASA initiatives, determine the associated technology and capability requirements as they relate to your organization, assess the current status of your technologies, and develop an approach which will position your organization to respond to these requirements

Individual Responsibility

When we speak of JSC's technical competence, we are referring to that technical expertise which individual JSC employees have brought to JSC and/or have acquired in carrying out their responsibilities over the years. Ultimately, then, strengthening JSC's technologies and capabilities can only be accomplished by enhancing the capability of each individual JSC employee on the JSC team.

If JSC's technical competence lies in the individual employee, that means that the individual employee must play a key role in enhancing JSC's capabilities. For each of you, it is both an additional work load and a challenge. Today's work load will not be reduced. Yet there is an opportunity for you to expand your skills and capabilities by comparing these new initiatives and their associated requirements to your skills, disciplines, competencies, and responsibilities, and develop your our own individual action plan.

On the two pages that follow, there is a possible scenario envisioned for NASA in the year 2000. There is a basic question which you may want to ask yourself after reading it.

WHAT ROLE DO I WANT TO PLAY IN MAKING THIS SCENARIO HAPPEN?

The year is 2000. It is Thursday, June 1. A JSC employee arrives at work early enough to get a cup of coffee before sitting down at his work station. He logs in to the JSC Information Bulletin Board:

WELCOME TO THE JSC INFORMATION BULLETIN BOARD . . .
TODAY IS: THURSDAY, 01 JUNE, 2000, CURRENT TIME: 07:50:23

He types, "LOGON NASA INFONET: DISPLAY NEWS RELEASES/TODAY: KEY ON ⊟ JSC, MARS, LUNAR, SHUTTLE, STATION," and text fills the screen:

NASA Information Network

Yesterday, it was announced that an increase in orbital transfer vehicle traffic is planned as construction of the lunar base begins next year. Additionally, orbital maneuvering vehicle traffic around the Station is on the rise as satellite servicing requests from private industry increase. It is expected that the Space Industry Consortium, comprised of representatives from major aerospace and space processing companies, will purchase their own OMV to reduce the present fleet's work load. The NASA also expects an increase from two Shuttle-C flights per year to three per year for Station resupply. Plans are being formulated to deal with the increase in traffic at the Station without affecting experiments.

Last week, the Agency approved funding for a phase A study for a manned Mars initiative. The study will focus on development of mission objectives, new vehicle concepts, and identification of critical technology areas requiring further development to support such an initiative. The manned Mars initiative is seen as the next logical step in support of the Agency's long-range objectives of solar system exploration and expanding the human presence in the solar system.

The announcement to support the phase A study came exactly one year after the U.S.S.R. announced its plans to fly a similar mission in the 2005 to 2007 timeframe. While no formal agreements have been negotiated, Agency officials have not ruled out the possibility of a joint U.S./ESA mission.

The NASA Administrator established a Manned Mars Program Office at Headquarters. Consideration is being given to assigning JSC the responsibility for mission elements such as trans-Mars/Earth vehicle, lander/ascent vehicle, mission operations, and planetary science investigations. Task assignments are being based on successes in the manned program, the lunar base development, and the Mars sample return mission. The Administrator stated that a project of this magnitude will commit the resources of many of the NASA field centers and that additional funding will be sought from Congress beginning this summer.

The NASA announced today that the delivery of the second advanced Shuttle vehicle, Liberty, is still scheduled for next week. The Liberty, which has just completed atmospheric flight testing and checkout, will be flown to KSC where it will be officially added to the NSTS fleet in a public ceremony. The President is expected to attend.

The new vehicle will be a welcome addition to the NSTS fleet. The new Shuttle concept is expected to be operational after a series of orbital flight tests. Mission planners state that this will greatly supplement the Earth-to-orbit vehicle fleet which includes the original Shuttle fleet, the advanced launch system managed by the Department of Defense, and the unmanned Shuttle-C's. Shuttle II is hailed as an asset in meeting increased space transportation needs seen with increasing Space Station activities and the announcement of the manned Mars initiative. Agency officials also note that additional Shuttles will be needed as the Agency begins phasing out the original Space Shuttle Orbiters which have been operational since the early 1980's.

The NASA is planning a ceremony to commemorate the thirty-first anniversary of the first Moon landing and the twenty-fourth anniversary of the landing of the Viking mission on Mars. Details released yesterday by Headquarters state that two crew-members at the lunar exploratory outpost will venture from the base site on July 20 to plant an American flag at the Sea of Tranquillity, the site of the Apollo 11 landing in 1969. The date will also be marked on Mars as the Mars rover, still operational after the Mars sample return mission, will be in the vicinity of the Viking I lander and is expected to send back images of the spacecraft, which landed on July 20, 1976. Mars rover operators at JPL note that the images returned on Viking I will be used to examine the long-term effects of exposure to the martian environment.

.....End News Request.....

CONTRIBUTORS TO THE JSC STRATEGIC PLANNING PROCESS

Since the JSC strategic planning process was initiated last fall, over 200 employees have been substantially involved in the process. For most of them, the strategic planning effort was an extra assignment undertaken concurrent to their normal work load. Individuals participated in a variety of ways. Some individuals were on the assessment teams which initiated the process, other individuals were on the strategic development teams, and others participated in the technology assessment briefings given by JSC technical divisions. It is the broad participation of employees throughout the Center which has made this process a success.

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